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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/781,196	02/18/2004	Gerard Francis McLean	1134.15A	1748

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SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
CHUO, TONY SHENG HSIANG	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/781,196	MCLEAN ET AL.	
	Examiner	Art Unit	
	Tony Chuo	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-28 and 31* is/are pending in the application.

4a) Of the above claim(s) *19-28* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-18 and 31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/29/07 has been entered.

Response to Amendment

2. Claims 1, 2, 4-28, and 31 are currently pending. Claims 3, 29, and 30 are cancelled. Claims 19-28 are withdrawn from further consideration as being drawn to a non-elected invention. The amended claims do not overcome the previously stated 103 rejections. Therefore, claims 1, 2, 4-18, and 31 stand rejected under the following 103 rejections. In addition, claims 1, 2, 4-18, and 31 are also rejected under the following new 103 rejections in view of Song (WO 02/103834).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-2, 5-7, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okaniwa et al (JP 2003-082012) in view of Singleton et al (US 5425865).

The Okaniwa reference discloses a cross-linked polyelectrolyte that is produced by polymerizing a monomer in the presence of a proton conductive polymer that has a sulfonic group and a carboxylic acid group for use in a primary battery, secondary battery, or fuel cells (See Abstract and paragraph [0008]). In addition, it also discloses a polymerization solvent that is dimethylacetamide (See paragraph [0077]).

Examiner's note: It is well know in the art that a fuel cell comprises an anode gas diffusion electrode, a cathode gas diffusion electrode, an anode catalyst layer in contact with the anode gas diffusion layer and cathode catalyst layer in contact with the cathode gas diffusion electrode, and a electrolyte membrane in contact with the gas diffusion electrode and the catalyst layers. It is also inherent that the electrolyte is in intimate contact with the catalyst layers, and is configured to fill a desired or arbitrary space within the fuel cell since there is always a space within the fuel cell for the electrolyte.

However, Okaniwa et al does not expressly teach a first vinyl monomer comprising a COOH group, a cross linking agent comprising a second vinyl monomer, and a photo-initiator. The Singleton reference discloses a polymer membrane comprising: a first polymeric material as a support; a second polymeric material comprising a vinyl monomer that includes carboxylic acid; a crosslinking agent that is

divinylbenzene, and a photo-initiator (See column 5, lines 19-39 and column 6, lines 51-64).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Okaniwa electrolyte to include a first vinyl monomer comprising a COOH group, a cross linking agent comprising a second vinyl monomer, and a photo-initiator in order to enable the electrolyte to wet more quickly and more thoroughly so that the resistance to ionic migration through the membrane becomes stable quickly and at an advantageously low value.

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okaniwa et al (JP 2003-082012) in view of Singleton et al (US 5425865) as applied to claim 1 above, and further in view of Linder et al (US 5599506).

However, Okaniwa et al as modified by Singleton et al does not expressly teach a cross linking agent comprising di-vinyl sulphone. The Linder reference discloses a gel membrane where di-vinyl sulphone is used as the cross linking agent in the polymerization (See column 7, lines 20-27).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Okaniwa/Singleton electrolyte to include a cross linking agent that is di-vinyl sulphone in order to form a mechanically strong gel membrane with the proper porosity for ionic conductivity.

6. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okaniwa et al (JP 2003-082012) in view of Singleton et al (US 5425865) as applied to claim 1 above, and further in view of Nam et al (US 2003/0219640).

However, Okaniwa et al as modified by Singleton et al does not expressly teach an electrolyte comprising a protonic polymer that is sulphonated polyether ether ketone and an elasticizing agent that is acrylonitrile. The Nam reference discloses a proton conducting polymer membrane comprising a protonic polymer that is sulphonated polyether ether ketone and an elasticizing agent that is acrylonitrile (See paragraphs [0019],[0020]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Okaniwa/Singleton electrolyte to include a protonic polymer that is sulphonated polyether ether ketone and an elasticizing agent that is acrylonitrile in order to improve membrane conductivity, flexibility, water remaining ability, dimensional stability, and adhesion bonding ability.

7. Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okaniwa et al (JP 2003-082012) in view of Singleton et al (US 5425865) as applied to claim 1 above, and further in view of Puffer et al (US 3403054).

However, Okaniwa et al as modified by Singleton et al does not expressly teach first and second spacers connected to the first and second electrodes wherein the electrolyte is disposed between the first and second spacers and an injection port disposed between the first and second electrode forming a cavity wherein the electrolyte is disposed in the cavity; a porous substrate; at least one channel disposed in the porous substrate having a first channel wall and a second channel wall wherein the first electrode is disposed in the first channel wall and the second electrode is disposed in the second channel wall, and the electrolyte is disposed in the channel.

The Puffer reference discloses first and second spacers "16a" & "16b" connected to the first and second electrodes "19" wherein the electrolyte is disposed between the first and second spacers and an injection port "18" disposed between the first and second electrode forming a cavity wherein the electrolyte is disposed in the cavity "17" (See Figure 1). Examiner's note: The ion exchange membrane system "16" is a substrate that includes a channel "17" with first and second channel walls "16a" & "16b" where the electrolyte is disposed in the channel and the first electrode "19" is disposed in the first channel wall and the second electrode is disposed in the second channel wall. In addition, it is implicit from the teaching of Puffer et al that the substrate is porous because otherwise the ion exchange membrane would not function to transport ions from one electrode to the other electrode.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Okaniwa/Singleton fuel cell to include first and second spacers connected to the first and second electrodes wherein the electrolyte is disposed between the first and second spacers and an injection port disposed between the first and second electrode forming a cavity wherein the electrolyte is disposed in the cavity; a porous substrate; at least one channel disposed in the porous substrate having a first channel wall and a second channel wall wherein the first electrode is disposed in the first channel wall and the second electrode is disposed in the second channel wall, and the electrolyte is disposed in the channel in order to simplify the manufacturing of the fuel cell by utilizing a structure that is capable of injecting a liquid electrolyte in between the two electrodes.

8. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okaniwa et al (JP 2003-082012) in view of Singleton et al (US 5425865) and Puffer et al (US 3403054), and further in view of Fly et al (US 2002/0114990).

However, Okaniwa et al as modified by Singleton et al and Puffer et al does not expressly teach a substrate that is a porous media. The Fly reference discloses a substrate that is a porous media (See paragraph [0017]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Okaniwa/Singleton/Puffer fuel cell to include a substrate that is a porous media in order to ensure an essentially uniform distribution of gases through the channel in the porous media across the surface of the membrane electrode assembly.

9. Claims 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okaniwa et al (JP 2003-082012) in view of Singleton et al (US 5425865) and Puffer et al (US 3403054) as applied to claim 13 above, and further in view of Mayer et al (US 6332990).

However, Okaniwa et al as modified by Singleton et al and Puffer et al does not expressly teach a substrate that comprises a carbon filled epoxy, a carbon filled polymer, a manganelli phase titanium oxide, a foam, a monolith of porous material, an aerogel, a mat, a felt, a paper, a mesh, or laminates thereof. The Mayer reference discloses a substrate that is a carbon aerogel mixed with polymers (See column 3, lines 56-60).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Okaniwa/Singleton/Puffer fuel cell to include a substrate that is a carbon aerogel mixed with polymers in order to simplify the manufacturing of the substrate by allowing the precursor materials to be spread in thin films.

10. Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okaniwa et al (JP 2003-082012) in view of Singleton et al (US 5425865) and Puffer et al (US 3403054) as applied to claim 13 above, and further in view of Jones et al (US 5998054).

However, the Okaniwa et al as modified by Singleton et al and Puffer et al does not expressly teach a base comprising a distribution plenum for transporting the electrolyte, at least one fluid port in fluid communication with the channel, at least one master port for receiving the electrolyte into the base, and a cap disposed over the first electrode to seal the electrode. The Jones reference discloses a base comprising a distribution plenum "134" for transporting the electrolyte, multiple fluid ports "131" in fluid communication with the channel, one master port "132" for receiving the electrolyte into the base, and a cap disposed over the first electrode to seal the electrode (See Figure 3).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Okaniwa/Singleton/Puffer fuel cell to include a base comprising a distribution plenum for transporting the electrolyte, multiple fluid ports in fluid communication with the channel, one master port for receiving the

electrolyte into the base, and a cap disposed over the first electrode to seal the electrode in order to simultaneously inject the electrolyte into multiple unit cells in the fuel cell stack.

11. Claims 1-2, 5-7, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song (WO 02/103834) in view of Singleton et al (US 5425865).

The Song reference discloses a polymer electrolyte membrane fuel cell comprising electrode layers of a cathode and an anode, each of which comprises polymeric binder and catalytically active powders adsorbed to a carbon based surface such as carbon black, that are bonded to the polymer electrolyte membrane, wherein the polymer electrolyte membrane is a composite electrolyte membrane comprising a an ion exchange resin having cation exchanging groups, such as sulfonic acid, carboxylic acid, and phosphoric acid, on the side chains and a thermally curable oligomer (See page 1, lines 13-18, page 8, lines 9-30, and page 11, lines 1-4). In addition, it also discloses a polymerization solvent that is dimethyl acetamide (See page 16, lines 11-12).

Examiner's note: It is also inherent that the electrolyte is in intimate contact with the catalyst layers, and is configured to fill a desired or arbitrary space within the fuel cell since there is always a space within the fuel cell for the electrolyte.

However, Song does not expressly teach a first vinyl monomer comprising a COOH group, a cross linking agent comprising a second vinyl monomer, and a photo-initiator. The Singleton reference discloses a polymer membrane comprising: a first polymeric material as a support; a second polymeric material comprising a vinyl

monomer that includes carboxylic acid; a crosslinking agent that is divinylbenzene, and a photo-initiator (See column 5, lines 19-39 and column 6, lines 51-64).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Song electrolyte to include a first vinyl monomer comprising a COOH group, a cross linking agent comprising a second vinyl monomer, and a photo-initiator in order to enable the electrolyte to wet more quickly and more thoroughly so that the resistance to ionic migration through the membrane becomes stable quickly and at an advantageously low value.

12. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Song (WO 02/103834) in view of Singleton et al (US 5425865) as applied to claim 1 above, and further in view of Linder et al (US 5599506).

However, Song as modified by Singleton et al does not expressly teach a cross linking agent comprising di-vinyl sulphone. The Linder reference discloses a gel membrane where di-vinyl sulphone is used as the cross linking agent in the polymerization (See column 7, lines 20-27).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Song/Singleton electrolyte to include a cross linking agent that is di-vinyl sulphone in order to form a mechanically strong gel membrane with the proper porosity for ionic conductivity.

13. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song (WO 02/103834) in view of Singleton et al (US 5425865) as applied to claim 1 above, and further in view of Nam et al (US 2003/0219640).

However, Song as modified by Singleton et al does not expressly teach an electrolyte comprising a protonic polymer that is sulphonated polyether ether ketone and an elasticizing agent that is acrylonitrile. The Nam reference discloses a proton conducting polymer membrane comprising a protonic polymer that is sulphonated polyether ether ketone and an elasticizing agent that is acrylonitrile (See paragraphs [0019],[0020]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Song/Singleton electrolyte to include a protonic polymer that is sulphonated polyether ether ketone and an elasticizing agent that is acrylonitrile in order to improve membrane conductivity, flexibility, water remaining ability, dimensional stability, and adhesion bonding ability.

14. Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song (WO 02/103834) in view of Singleton et al (US 5425865) as applied to claim 1 above, and further in view of Puffer et al (US 3403054).

However, Song as modified by Singleton et al does not expressly teach first and second spacers connected to the first and second electrodes wherein the electrolyte is disposed between the first and second spacers and an injection port disposed between the first and second electrode forming a cavity wherein the electrolyte is disposed in the cavity; a porous substrate; at least one channel disposed in the porous substrate having a first channel wall and a second channel wall wherein the first electrode is disposed in the first channel wall and the second electrode is disposed in the second channel wall, and the electrolyte is disposed in the channel.

The Puffer reference discloses first and second spacers "16a" & "16b" connected to the first and second electrodes "19" wherein the electrolyte is disposed between the first and second spacers and an injection port "18" disposed between the first and second electrode forming a cavity wherein the electrolyte is disposed in the cavity "17" (See Figure 1). Examiner's note: The ion exchange membrane system "16" is a substrate that includes a channel "17" with first and second channel walls "16a" & "16b" where the electrolyte is disposed in the channel and the first electrode "19" is disposed in the first channel wall and the second electrode is disposed in the second channel wall. In addition, it is implicit from the teaching of Puffer et al that the substrate is porous because otherwise the ion exchange membrane would not function to transport ions from one electrode to the other electrode.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Song/Singleton fuel cell to include first and second spacers connected to the first and second electrodes wherein the electrolyte is disposed between the first and second spacers and an injection port disposed between the first and second electrode forming a cavity wherein the electrolyte is disposed in the cavity; a porous substrate; at least one channel disposed in the porous substrate having a first channel wall and a second channel wall wherein the first electrode is disposed in the first channel wall and the second electrode is disposed in the second channel wall, and the electrolyte is disposed in the channel in order to simplify the manufacturing of the fuel cell by utilizing a structure that is capable of injecting a liquid electrolyte in between the two electrodes.

15. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Song (WO 02/103834) in view of Singleton et al (US 5425865) and Puffer et al (US 3403054), and further in view of Fly et al (US 2002/0114990).

However, Song as modified by Singleton et al and Puffer et al does not expressly teach a substrate that is a porous media. The Fly reference discloses a substrate that is a porous media (See paragraph [0017]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Song/Singleton/Puffer fuel cell to include a substrate that is a porous media in order to ensure an essentially uniform distribution of gases through the channel in the porous media across the surface of the membrane electrode assembly.

16. Claims 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song (WO 02/103834) in view of Singleton et al (US 5425865) and Puffer et al (US 3403054) as applied to claim 13 above, and further in view of Mayer et al (US 6332990).

However, Song as modified by Singleton et al and Puffer et al does not expressly teach a substrate that comprises a carbon filled epoxy, a carbon filled polymer, a manganelli phase titanium oxide, a foam, a monolith of porous material, an aerogel, a mat, a felt, a paper, a mesh, or laminates thereof. The Mayer reference discloses a substrate that is a carbon aerogel mixed with polymers (See column 3, lines 56-60).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Song/Singleton/Puffer fuel cell to include a

substrate that is a carbon aerogel mixed with polymers in order to simplify the manufacturing of the substrate by allowing the precursor materials to be spread in thin films.

17. Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song (WO 02/103834) in view of Singleton et al (US 5425865) and Puffer et al (US 3403054) as applied to claim 13 above, and further in view of Jones et al (US 5998054).

However, the Song as modified by Singleton et al and Puffer et al does not expressly teach a base comprising a distribution plenum for transporting the electrolyte, at least one fluid port in fluid communication with the channel, at least one master port for receiving the electrolyte into the base, and a cap disposed over the first electrode to seal the electrode.

The Jones reference discloses a base comprising a distribution plenum "134" for transporting the electrolyte, multiple fluid ports "131" in fluid communication with the channel, one master port "132" for receiving the electrolyte into the base, and a cap disposed over the first electrode to seal the electrode (See Figure 3).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Song/Singleton/Puffer fuel cell to include a base comprising a distribution plenum for transporting the electrolyte, multiple fluid ports in fluid communication with the channel, one master port for receiving the electrolyte into the base, and a cap disposed over the first electrode to seal the electrode in order to simultaneously inject the electrolyte into multiple unit cells in the fuel cell stack.

Response to Arguments

18. Applicant's arguments filed 8/29/07 have been fully considered but they are not persuasive.

The applicant argues that Okaniwa describes a polyelectrolyte used in fuel cell that does not have the flexibility or characteristics of the electrolyte of the present invention because the polyelectrolyte of Okaniwa is built on aromatic monomers and is not curable in situ or capable of filling non-traditional spaces or configurations. This argument is not commensurate with the scope of the claims. There is no requirement in the claims for filling non-traditional spaces. In addition, a polymer electrolyte that is cured in situ is not given patentable weight because in product-by-process claims, the product itself does not depend on the process of making it.

The applicant also argues that the references combined do not disclose an electrolyte of the structure described in which strong physical or mechanical bonds are formed with one or more catalysts. The examiner disagrees because Singleton et al teaches polymerizing the second polymeric material in situ (i.e. within the fuel cell), which will result in the electrolyte layer being inherently bonded to the catalyst layers.

The applicant also argues that there is no motivation to combine the Okinawa reference and the Singleton reference because neither reference describes a motivation for developing an electrolyte for increasing the strength of bond or contact with an electrolyte and catalyst. The applicant is reminded that the motivation to combine does not have to be the same motivation as disclosed in the present application. In this case, the motivation to combine the references comes from the Singleton reference which is

to enable the electrolyte membrane to wet more quickly and more thoroughly so that the resistance to ionic migration through the membrane becomes stable quickly and advantageously low.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tony Chuo whose telephone number is (571) 272-0717. The examiner can normally be reached on M-F, 7:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TC

JONATHAN CREPEAU
PRIMARY EXAMINER